1

Hygiene of Respiration & Atmosphere

1876, began with Respiration &
, Lecture corresponded in length with
XII Lecture of 1866.
on Board, Subdiv. of Hygiene.

2d Lecture,
on Board, Excess of CO_2 in air
Modes of estim, atmosph. humidity
Weight of dry, vapor & Sat. air.
Method of exact determ. of rel. humidity
Shewed — merc. aneroid Barometer
Hygrodeik -
wet & dry bulb therm.

3d Lecture,
On Board,
Constant, variable & non essential constit. of atmosph.
Theories of transmission of
enthetic diseases:
Liebig's - exanth. & typhoid
Smyrnis - Cestin, molec. change
Richardson's asthenia - Sepsin
Klebs - Schizo germs.
Beales - trimorph, bioplasts.

Lecture XII (continued)

CONDITIONS OF HEALTHY RESPIRATION

Conditions of Healthy Respiration.

1. Sound Lungs & air-tubes.
2. Muscular Power.
3. Nerve Force
4. Pure Air
5. Renewal of Air.

CONTENTS OF THE ATMOSPHERE

Contents of the Atmosphere

Constants	Oxygen.	20.8 down to	20.61
	Nitrogen.	79.2 down to	77.95
variables	Carbonic Acid.		.04
	Watery Vapor.	about	1,40
	Ozone - variable		
non-essentials	Iodine. Nitric Acid - Ammonia		
	Carburetted Hydrogen.		
	Sulphurretted Hydrogen.		
	Phosphorretted Hydrogen.		
	Sulphurous Acid & Sulphuric acid		
	Organic Vaporous matter -		
	Organic Forms.		
	Mineral Particles -		

1874, after 10 Lectures in Etiology & Public Hygiene entered on Hygiene of Respiration at end of 10th Lecture.

This necessity we share with all the higher animals around us. The whale can remain under water an hour; the seal a quarter of an hour; aquatic birds several minutes; most birds and mammals a minute or two only. Pearl divers seldom continue submerged quite a minute; sometimes I believe they have accomplished a minute and a half. Strange stories are told, with positiveness and an air of authenticity, of some of the fakirs of India. I, for one, cannot believe them. Carpenter admits the possibility. E.g.;

[Leave a space equal to this]

RESPIRATION & THE ATMOSPHERE

Leaving digestion, our present subject is respiration & the atmosphere. Breathing is the first necessity of life. It is necessary to have good lungs, air tubes, muscular power, nerve force, pure air, and renewal of air. Examples of defective lungs are so numerous as to need mention. Consumption — Pneumonia — Croup &c.

NECESSARY CONDITIONS.

LOSS OF MUSCULAR POWER.

An example of the loss of muscular power is sometimes seen in illness. A person rises from bed and after walking a few steps is suddenly exhausted. This is especially the case if he have partial disease of the lungs.

NERVE FORCE.

Failure of nerve force is seen in death by chloroform, syncope or lightning.

Muscular power, nerve force & even the conditions of the lungs are affected by habit. Aeration of the blood may or may not have this effect. Amount of blood sent to the lungs must.

EFFECT OF HABIT.

H.

Dr. H. L. Davis advises H. Cook against gymnastics especially with the arms (up) in phthisis!

[space of 6 lines]

[space of 4 lines]

Case of Dr. Jos. Parrish, Senior — 1838 — 1874 —

Case of Dr. Geo. Drake — 1838 —

End of 13th Lecture, 1870

PULMONARY EXERCISE.

GENERAL EXERCISE.

In families disposed to phthisis, pulmonary exercise should be taken from early life.

There are two ways for this; 1st. by general exercise. The synergy is complete. ~~Not that it is a mistaken training.~~ If we exercise the legs we must exercise the breathing apparatus. In the high table lands of S. America the men have long chests, an extra development. ~~This proves that it is possible to expand the chest~~ gradually. Dr. H. H. Davis idea.

(Obligory)

VOCAL GYMNASTICS.

2nd. Vocal gymnastics: singing and speaking. We must remember that when it is not a predisposition, but actual consumption, this course would be injurious. Nevertheless it is good for consumptives to be in the open air as much as they can; offset with passive exercise.

PURE AIR → Dr. Jos. Parrish.

The necessity of pure air is obvious to all.

The contents of the atmosphere,

Leaves of plants will not act upon undiluted carbonic acid; but other gases besides O. & N. will dilute it so as to allow the leaf decomposition of the gas. (See Journ. of Sci. 1866 or 7).

End of 22nd Lecture, 1871

Light necessary

— Trees near houses — in a city, wholesome.

See *

By Angus Smith, M.A. of .5 per ct. better, open country, Dyers & Cornwall mines

1/2 1 100

100 20

* Leave here a space of 12 lines

~~Oxygen 20.61, Nitrogen 79.39~~ to 20.61 ~~Carbonic acid 0.04 to 0.06~~ to 79.95

CONTENTS OF THE ATMOSPHERE.

are: oxygen 20.8 pts.; nitrogen 79.2 pts. (considered as a diluent); vapor of water, essential to animal life; carbonic acid (do. to vegetables). &c.

SAME COMPOSITION EVERYWHERE.

It has almost exactly the same composition everywhere owing to winds, the action of plants, and to the law of the diffusion of gases.

DALTON

Dalton, Bowen, Babinet and Laws found a difference of oxygen

[redacted]

in a large hall, there were 5 to 10 times as much CO_2 as should be.

HAMMOND

Dr. Hammond states that in a room with no ventilation there is twice as much as should be.

Leblanc, 10 times normal amount in vault of Salpêtrière.

Leaves of plants will not act upon undiluted carbonic acid; but other gas besides O. & N. will dilute it so as to allow the leaf decomposition of the gas. (Lee. Journ. of Sci. 1866 or 7).

End of 22nd Lecture, 1871

Light necessary

Seeds

— Trees near houses — in a city, wholesome.

Instead of this slip, space 16 lines after comp. of atmosphere above

About $H_n^{-1}O$

In 100 vols — O. 20.61; N. 77.95; CO_2 .04 aq. vap. 1.40; with traces of NO_2 HNO_4 CH_2 3.45, & SO_2

Stas. Mellon, Chem. Vol. II

(PH$_3$ also — & NO_5 & SO_3) & organic matter

Leave here a space of 12 lines

Dr. Angus Smith, FRS, on .5 per cent. later, open country, Dyngs & Lawes' system

CONTENTS OF THE ATMOSPHERE.

are: oxygen 20.8 pts.; nitrogen 79. (considered as a diluent); vapor of water, essential to animal life; carbonic acid (do. to vegetables). &c.

SAME COMPOSITION EVERYWHERE.

It has almost everywhere the same composition owing to winds, the action of plants, and to the law of the diffusion of gases.

DALTON, MORREN, BABINET and LEWY

Dalton, Morren, Babinet and Lewy found a difference of oxygen at different places. Morren found more at the sea coast, & Lewy, less out at sea. Clemens found an excess over lakes, in the stratum of air near the surface.

CO_2

Carbonic acid is about from 4 to 6 parts in 10,000. Boussingault & Lewy found small differences in different places. out of door 1.5 part in 10,000 Pyr. Ste. Paire & Courtoy Parvis de Luna large amount.

DALTON

Dr. Dalton of New York found that in a large hall there were 5 to 10 times as much CO_2 as should be.

HAMMOND

Dr. Hammond states that in a room with no ventilation there is twice as much as should be.

Leblanc, 10 times normal amount in ward of Salpêtrière.

End of 13th Lecture, 1868.

(From last page

Coal-period ;

space for this, as direction on last page)

Aquarium ; &

trees in cities, - plants in a house,

or room ; beneficial : except while in bloom.

WE CANNOT BREATHE PURE CO_2

Pure carbonic acid cannot be breathed, not even 40 pr. ct.; yet we are always exhaling it.

When breathed (dilute) a gradual anæsthesia results.

REGNAULT.

Regnault asserts that animals can bear 23 pr. ct. of CO_2 if they have twice as much oxygen. (Pigeons; my exp.—space & time)

HAMMOND

Hammond says a bird can live in 45 oxygen, 30 nitrogen & 25 carbonic acid.

BARKER.

Dr. Hubert Barker found that no excess of oxygen will prevent the fatal effects of carbonic acid, if retained in the blood. If injected into the veins of dogs they will live if they have oxygen supplied, but if its head be tied they will die in a bag.

CO_2, A NEGATIVE POISON.

Carbonic acid is called a negative poison; it clogs the operations of life.

CARBONIC OXIDE

Carbonic oxide is by some accounted to be positively poisonous; but late experiments render this doubtful.

Instances of death from want-

End of 16th Lecture, 1873.

A gentleman present at the time of the occurrence
mentioned to me an incident
in Glasgow 1850, in theatre, panic about fire:
180 or 200 were rushing down a staircase into a small
room about folding doors open and fell together
upon these, closing them & about 80 were suffocated
to death — 100 or 120 taken out alive who
{2/3 suffocated}

BLACK HOLE OF CALCUTTA

of renewal of air, are familiar. That of the Black Hole of Calcutta is the most famous. 146 men were put into a room 18 feet square, having two small windows. All but 23 died.

STEAMER LONDONDERRY.

The steamer Londonderry was overtaken by a storm and the captain fastened down the hatches to prevent water getting in. Seventy-two died before they were [illegible]. Some years since Gen. Polissier

ALGERINE WAR.

During the Algerine war a general caught a band of the natives in a cave; setting a fire at the mouth of the cave he suffocated them. Space 10 lines Avondale 1870 - 200 suffer by fire damp in Mines, & Potts, 1871, 30 - die, fire in shaft [illegible]

SUFFOCATION FROM

[illegible] ation from carbonic acid from human breath, [illegible]fferent. In exhaling, matter is thrown out. [illegible]ffocated rooms have an [illegible]t smell on entering. [illegible]ously, suicide is commit[illegible] charcoal fire. There is

SUICIDE

amount.

The feature of the southern list was a firm feeling in new South Carolinas, which left at 27¼ a ½.

The railway and miscellaneous list was d during the morning, with prices alternat weak and strong. During the afternoon general market stiffened up ¼ a ½ per cen Wabash, Ohios, and Boston, Hartford a Erie being the leading features.

Street quotations at 5½ P. M.:

N. Y. C. & Hudson consolidated, 92¼ a 92 N. Y. C. & Hudson certificates, 87½ a 87 Harlem, 121 a 122½; Erie, 30¾ a 30¾; Re ing, 113¼ a 113¾; Lake Shore, 83 a 83¾; scrip, 81¾ a 81¾; Wabash, 64¼ a 64¼; Pit burgh, 127½ a 127¾; Northwestern, 60¾ a 60 do. pref., 90¼ a 90¾; Rock Island, 103 a 103 Ft. Wayne, 97 a 97½; Milwaukee & St. Pa 55 a 55¼; do. do. pref., 77¾ a 78; Ohio a Mississippi, 43¼a43¾; New Jersey 103½ a 10 Union Pacific, 28 a 28¼; W. U. Telegrap 68¼ a 68¾; Pacific Mail, 47¼ a 47¼; Adam Express, 85 a 85½; Wells, Fargo & Co. Expres 57 a 60; Amer. Mer. Union Express, 51¼ a U. S. Express, 58¾ a 58½; Michigan Centr 116 a 118; Illinois Central, 139¼ a —; Maripo 1 a 1½; do. pref., 1¼ a 2.

NEW YORK, Nov. 23.—Cotton quiet a steady at 18¼ a 18¾c. Flour dull and fav buyers. Whisky, 94c. Wheat unsettled, a

10

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in Glasgow 1850, in theatre; panic about pit;
180 or 200 men & boys rushing down a stairway into a small
room where folding doors opened inwards; fell together
against these, closing them & about 80 men suffocated
to death — 100 or 120 taken out alive &c.

{2/3 suffocated}

ATMOSPHERIC AIR.—The English "Health of Towns Commission," which has made careful experiments upon the air breathed by large masses of people, reports that the atmosphere of great manufacturing cities is less deleterious than the air of unventilated rooms inhabited by human beings. Thus, in the city of Manchester the factory chimneys throw out daily two thousand tons of carbonic acid gas, and yet the air is not seriously contaminated. The greatest enemy to man is his own breath, as has been proved by a table prepared by the "Health Commission." The number of parts of carbonic acid in ten thousand parts of air taken from different places are given as follows: Pure atmospheric air, 4; streets of great cities, 6; stables, 7; pit of Comic Opera House in Paris, 15; ceiling of Comic Opera House, 28; asylum, 17; hospital, 30; dormitory at night, 52; bedroom on rising in morning, 48; bedroom after two hours' ventilation, 16; railway carriage, 31; workshop, 19; lecture hall, 22; and a well-filled schoolroom, 72.

BLACK HOLE OF CALCUTTA

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ALGERINE WAR.

During the Algerine war a general caught a band of the natives in a cave; setting a fire to the mouth of it he suffocated them.

Space 10 times Avondale 1870 – 200 suffer by fire in mine. Pittston, 1871, 30 – ditto, fire in shaft. Mines.

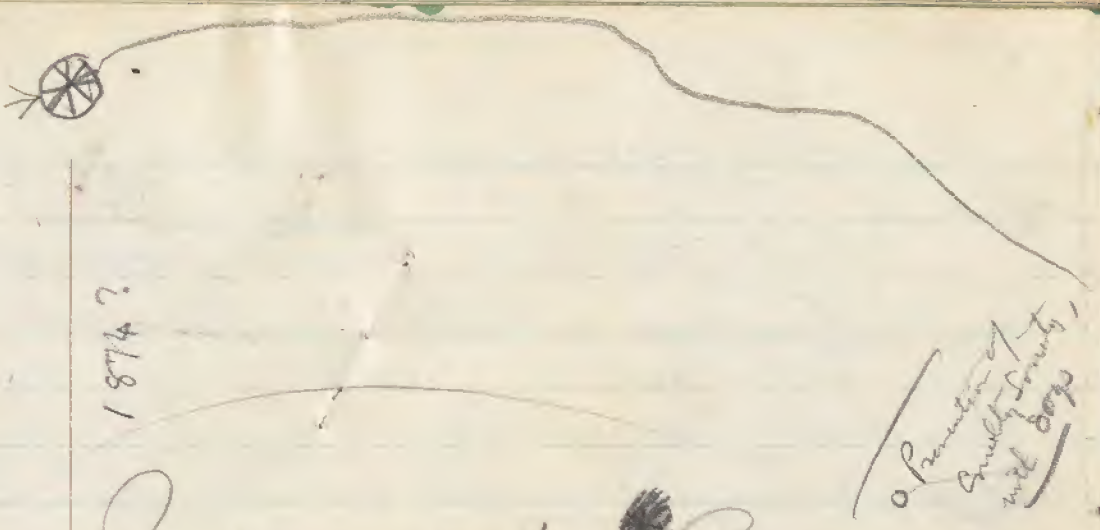
SUFFOCATION FROM CO_2 & FROM HUMAN BREATH.

Suffocation from carbonic acid and that from human breath, are quite different. In exhaling, organic matter is thrown out. Badly-ventilated rooms have an unpleasant smell on entering.

SUICIDE IN PARIS.

More of this topic presently.

In Paris, suicide is committed by a charcoal fire. There is



1877?

A fracture of Occipital Squamous with loss

End of 14th Lecture, 1867.

13th 1869

* In 1871, a young man from the country, in one of the Western cities, ^ on going to bed in his room at a hotel, blew out the gas. He was waked up by unpleasant feelings — got up & lit his gas; was sick at stomach, vomited, felt a little better, blew out his gas and again lay down. After that he lay still till somebody broke into his room to find him almost dead.

Two students of the
one of them after
suffocated by a
fire. Dr. Jackson
ed them, by means of
en. A clergyman (whom I attended)
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It is remarkable that CO_2 has not yet been successfully
used as an anæsthetic in surgery.
On the other hand, those who
were in the Black Hole died sud-
denly. Some had convulsions. Several
retained consciousness to the last.

VIOLENCE OF DEATH IN THE BLACK HOLE

BURNING-GAS.

Burning gas contains a little carbonic
acid, carburetted hydrogen, sulphu-
etted hydrogen & sulphurous acid.
It may be fatal; but its strong
smell usually gives warning. Instances
have happened, as in leakage of
gas pipes. A gentleman from Cuba in New York, 1866.

CO_2 SUFFOCATION.

True carbonic acid suffocation
is the most likely to happen. A
landlord who wanted to get rid of
a tenant stopped up the chimney

12

Seventy Children Rendered Insensible by Coal-Gas in a School-Room.

SUSQUEHANNA DEPOT, Pa., Dec. 12.—Seventy children attending school at Oakland, a little village near here, had a narrow escape from suffocation from coal gas on Tuesday morning. The presence of the poison in the air was not known to the teacher until about eleven o'clock, when the smaller children began to drop from their seats to the floor, where they lay unconscious. The teacher then, greatly alarmed, announced the dismissal of the school, but not over half the scholars could get out of their seats, and the remainder rapidly fell into unconsciousness. As quickly as possible they were dragged into the air and laid on the ground. A few of them revived on getting into the air, but twenty-five remained unconscious. A physician was summoned, who succeeded, after long and persistent efforts, in reviving all of them. One little girl was three hours insensible. If they had remained in the school-room but very little longer half of them at least would have been past all relief. Several are yet very sick from the effects of the gas. The foul air was driven into the room by the stove-pipe having by some means been jammed against the back of the chimney, preventing draught.

1874?

Prevention of Cruelty Society

Last of 14th Lecture, 1867.

13th 1869

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no pain. Two students of the University (one of them, afterwards Dr. Morgan) were suffocated by a charcoal fire. Dr. Jackson resuscitated them, by means of pure oxygen. A clergyman (whom I attended) almost lost his life in the same manner. In these cases there was no suffering.

CASES OF Dr MORGAN, AND OF A CLERGYMAN.

* It is remarkable that CO_2 has not yet been successfully used as an anæsthetic in surgery.

On the other hand, those who were in the Black Hole died suddenly. Some had convulsions. Several retained consciousness to the last.

VIOLENCE OF DEATH IN THE BLACK HOLE

BURNING-GAS.

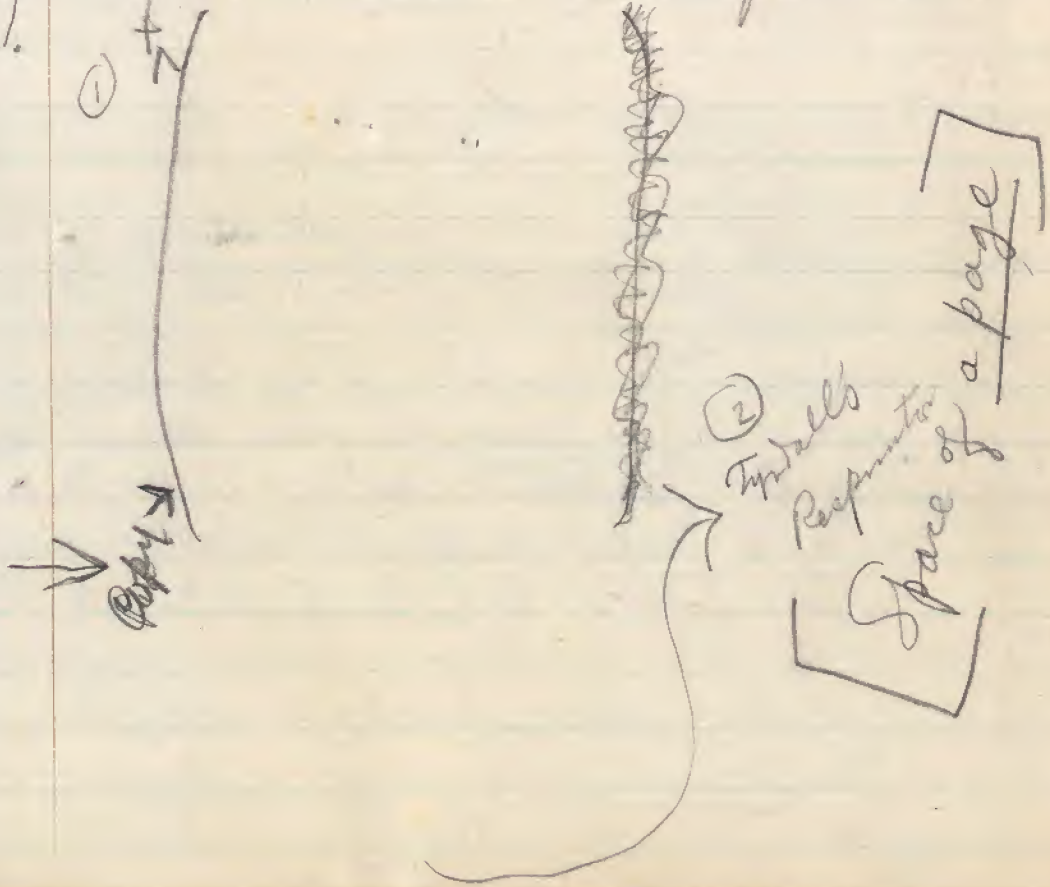
Burning gas contains a little carbonic oxide, ammonia, or CNH, sulphuretted hydrogen, bisulphide of carbon, & sulphurous acid. It may be fatal; but its strong smell usually gives warning. Instances have happened, as in leakaged gas pipes. A gentleman from Cuba in New York, 1866. *

CO_2 SUFFOCATION.

True carbonic acid suffocation is the most likely to happen. A landlord who wanted to get rid of a tenant stopped up the chimney

*

See "Nature", end, in 1872, for
Richardson's ~~experiments~~ (& Tyndall's experiments) with
a respirator in carbonic atmosphere; decoupé
for smokers. Very efficient but fatiguing to
use.



old deep wells — & brewers' vats.

so that the fire would not be supplied with draught. It was, and consequently the family were killed.

In Lawes' Physiology of Common Life

EFFECTS OF IMPURE AIR ON TWO DIFFERENT BIRDS.

a few meantime

EFFECTS ON TWO GIRLS.

CAUSE.

Dog lived 4 minutes without fresh (1875) in an ice house.

ROOMS WANTED AND TO RENT.

TO RENT—TO A SMALL, RESPECTABLE family, in exchange for board, the dwelling part a desirable up-town drug store, near Fifth and th street and Second and Third street cars. Address B. M. P., Ledger Office. thsS

TWO FRONT ROOMS TO RENT, APPLY AT 1741 Crosby street, above Ridge and Columbia enues. *30

TO LET—DWELLING PART OF HOUSE, bath, hot and cold water, 1232 S. Second st. 2t*28

TWO FURNISHED ROOMS IN SECOND story, 1013 Oxford street. *157

ROOMS TO LET, S. E. CORNER MARSHALL and Poplar. Entrance on Marshall, No. 803. *4

TO LET—ROOMS, WITH AND WITHOUT power, N. W. corner Twelfth and Filbert streets, 2t*55

1138 Chesnut street.

TO RENT—TWO OR THREE ROOMS, ON SEcond floor, 1200 Deacon street, first house above rard avenue. *27

TO LET—FOR MANUFACTURING PURPOSES, the Second, Third and Fourth Floors of building North Sixth street. 3t*173

FURNISHED ROOMS FOR SINGLE GENTS AT $1 per week. 147 N. Thirteenth street. *15

TWO ROOMS TO RENT FOR STORAGE, OR to a single, respectable person, in a family of lts. Apply or address 49 North Thirty-eighth et, West Philadelphia. *211

WANTED—TWO GENTLEMEN LODGERS IN a private family, 1323 Brandywine st. 3t*199

TO RENT—SECOND, THIRD AND FOURTH-story rooms of 1108 Market street; have been used Boys' School for the last twenty-eight years. 20x et rooms. 3t*135

TO LET—A PLEASANT FURNISHED ROOM for lodging to a single gentlemen. No. 923 Vine et. 3t*179

ROOMS TO RENT, 1620 PINE STREET. *208

TO LET—A FINE ROOM, THIRD FLOOR, front. 707 Sansom street *191

TO LET—A FURNISHED ROOM, 926 FILbert street. *229

TO RENT—A FURNISHED ROOM FOR MAN and Wife, 422 North Fourth street. *233

TO LET—TWO SECOND-STORY ROOMS, NO. 1221 Davis street. *330

TWO ROOMS TO RENT, UNFURNISHED. 709 Bayard street, below Wharton. *203

TO RENT—TWO FURNISHED OR UNFURnished front Rooms in a very desirable central ation. Address F. O. S., Ledger Office. 2t*216

FURNISHED ROOMS FOR A RESPECTABLE gentleman and wife; also for single gents, $1 per ek. 1013 Morgan st., between Race and Vine. *426

FURNISHED ROOM FOR GENTLEMAN IN private family, at 706 Pine street. *537

TO RENT—TWO PLEASANT ROOMS, NEWLY papered and painted. Inquire 1707 Thompson. *549

ROOMS TO RENT, N. E. CORNER OF THIRteenth and Master streets. 2t*220

TO LET—FURNISHED ROOMS, 614 SOUTH Washington Square and 247 South Sixth st. *590

FURNISH

placed in an it will live for bird be af- ced, it (no. 2) will first part in has by itself to the

and a feble occasion a room with the healthy one in good health, the oxygen is greater It is greatest inals in the in a bird it in a whole ie. the above tation of the ge of air.

See "Nature", end, in 1872, for Richardson's experiments (& Tyndall's) with a respirator for miners [illegible] atmosphere; designed but [illegible] to use.

IMPURE AIR.—"Air and Rain, the Beginning of a Chemical Climatology," is the title of a book just published in London. The author is Dr. Robert Angus Smith, who essays to throw new light upon the origin of diseases. He gives in an elobarate series of tables some valuable information regarding the state of air in mines. It is found that even in the worst mines the amount of oxygen does not go below 18 per cent., while sometimes the excess of carbonic acid more than makes up for the deficiency of oxygen, the reason being, as Dr. Smith remarks, that when gunpowder is exploded carbonic acid is generated without oxygen being consumed.

In connection with an inquiry for the Mines Commission, Dr. Smith made numerous experiments on the air of confined places, as he modestly says, but in reality he shut himself up sometimes for more than two hours at a time in a small bedchamber, the cubic contents of which were about 170 feet. The following is the record of one of his experiments in this chamber:

"After the experiments on the combustion of candles we entered with candles and a spirit lamp. The lights were soon extinguished, and it was found impossible to rekindle them with matches; wooden matches were used, they refused to ignite. Still we breathed without difficulty at first, but a gradual feeling of discomfort appeared of a kind which is not easily described; it was restlessness and anxiety without pain, while the breathing increased in rapidity. Afterwards gas was ignited, and it burned with brilliancy. On entering after the gas had gone out, candles were extinguished as rapidly and completely as if they had been thrust into water; nevertheless we still breathed, and although every one was anxious to go out, no very correct description of the feelings could be given. I stood on a chair, and then a feeling of incipient fainting began, but the senses were not annoyed by anything beyond a feeling of closeness, by no means so unpleasant as a schoolroom or close end." By means of this chamber Dr. Smith made many valuable experiments of the effect of carbonic acid upon the lungs, and he concludes as follows:

"The fact that men and animals die very rapidly from inhaling pure carbonic acid, while they live comparatively much longer in nitrogen or hydrogen gases, is explained by this: That in an atmosphere of carbonic acid the blood cannot give off any portion of that gas, but, on the contrary, absorbs more of it, by which the small proportion of oxygen in venous blood is expelled from the blood, and consequently its vital functions are much impeded, nay, arrested. When the inspired air has the same composition as that which is exhaled, the object of respiration is no longer attained. The venous blood is no longer changed into arterial, difficulty of breathing, and finally suffocation come on, just as if the mouth and nose had been closed."

The effect of carbonic acid in the air is to make the pulse fall and increase the number of inspirations.

(1) Copy

(2) Tyndall's Respirator [illegible] Space of a page

old deep wells — & brewers' vats.

supplied with draught. so that the fire could not be It was lit, and consequent- ly the family were all killed.

EFFECTS OF IMPURE AIR ON TWO DIFFERENT BIRDS.

In Lewes' Physiology of Common Life, a curious experiment is mentioned. If a bird be placed in an air-tight jar, it will live for hours. If another bird be introduced a few meantime first. it (no. 2) will die. The first bird put in has by degrees adapted itself to the change of air.

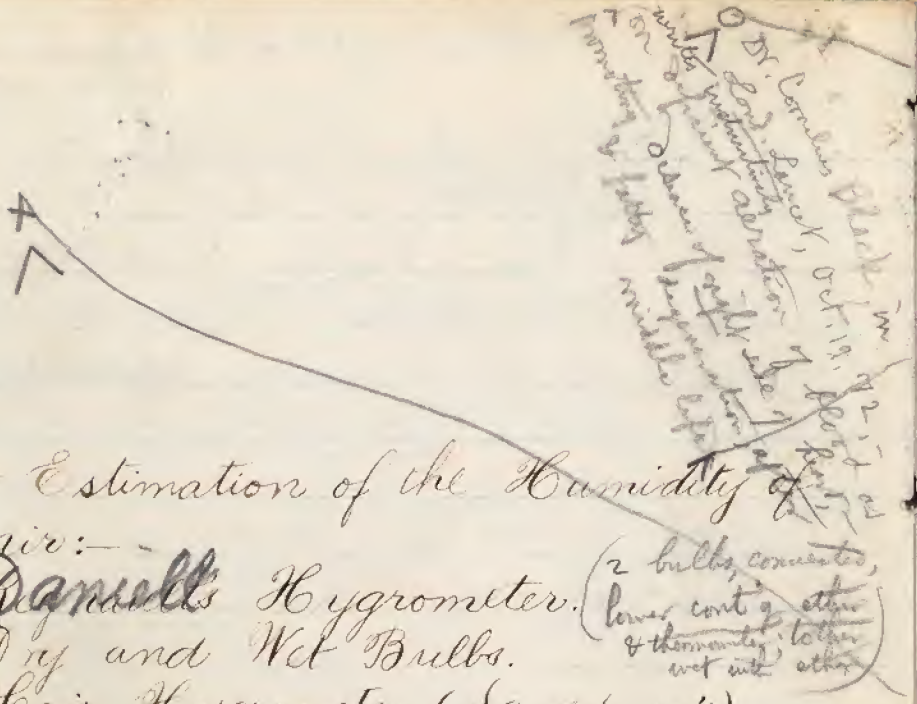
EFFECTS ON TWO GIRLS.

When a healthy and a feeble girl were left for some occasion in a room with a charcoal fire, the healthy one suffered most. In good health, the consumption of oxygen is greater than in ill health. It is greatest in the highest & most active animals & in the best bodily condition. This in a bird it is quicker than in a reptile &c. This will explain the above.

CAUSE.

Dog lives 4 minutes without food (1875) Brown Sequard.

There is an adaptation of the system to the change of temper air.



ESTIMATION OF HUMIDITY OF THE AIR.

For Estimation of the Humidity of the air:—

Daniell's Hygrometer. (2 bulbs, connected, lower cont. ether & thermometer, bottom wet with ether)

Dry and Wet Bulbs.

Hair Hygrometer (Saussure's).

Weighing.

~~Barometer.~~

WEIGHT OF AIR AND VAPOR.

Weight of 1 cubic foot of dry air at 60° Fahr. ——— 536.28 grs.

Weight of 1 cub. foot vapor — 577. grs.

Weight of 1 cub. foot of air saturated with moisture — 532.84 grs.

~~Pressure of the air, by barometer.~~

Dr. Cornelius Black, on deficient aeration of blood as promoting disease of right side of heart, & fatty degeneration after middle life.

EXCRETION INCREASED.

The excretions are increased. Thus goes on more rapidly when time is allowed for adaptation. It is certain that they who live in bad air do not suffer the injury to be anticipated. Judges in courts, for example.

Lecture XIII
Lecture XIV } Cholera (1866.)
Lecture XV.

WATERY VAPOR.

The next constituent which we will consider, is watery vapor. It is by no means nonessential. A certain amount is indispensable. This is proved by the hot winds of Africa, which, deprived of all moisture, are often fatal to life.

ITS NECESSITY.

SIMOONS.

DAMPNESS.

Opposed to dryness, is great dampness. In connection with cold, it is very injurious.

The determination of the amount of moisture belongs to meteorology. This is a science of great complexity, and as yet quite immature. — Loomis, Hunt, Alexander

Don't copy

End of 1st Lecture 1872.

The moisture in the air may be determined by

The Barometer;
Actual weighing;
Dew-point (Daniell's Bulb Hygrometer);
Saussure's Hair Hygrometer;
Dry & Wet Bulbs (Mason's);
Hygrodeik (Edson's).

[After this, "Tools & Apparatus"]

At Philadelphia, the highest barometric pressure is, daily, at about 9 A.M.; the other maximum between 9 & 10 in the evening; the two minima, at about 4 in the morning & 4 in the afternoon. The monthly averages of barometric pressure are in most places (except in the extremes of Asia) about the same throughout the year; although the amount of vapor, with us, is quite different, being greatest in July & least in January; 4 times as much in July as in January. The extreme fluctuations of the barometer seldom exceed 3 inches. At Boston they are between 31⅛ & 28½ inches, & at London 3 inches of range; in Iceland & St. Petersburg 3½; at one place near the Equator, less than half an inch for years together. As to variations of humidity, the dew point in ordinary pleasant weather here is 10° & 15° below the temperature of the air. It sometimes, however, is 30° or 40° below it. In India, sometimes 61° below it; in parts of California 78°. [illegible] only 6 per cent of the moisture necessary for its saturation.

17

ir, has
emperature
al ways

in dry
xpansion.
ometer
the pres-

& Hygroscopy.

o° weighs
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+ 52° 1 by 4½ gr. of
ot; at 77°, 9.8 gr.
t will

[Barometer]

lls hygrom-
temper-
ll begin
ly cooled.
e will be
N. Mexico,

by cod-
rometer.

(5) The explanation of these "gaseous pressure" changes is, the heating of the earth by the sun and the air over the earth; the warmed air thus expanding into a higher column, which then runs off from the top to the lower atmosphere around it; making a lighter column, because expanded, & so tending to lessen the air pressure on the barometer. But, as these two sorts of pressure, — that of vapor and that of the gaseous atmosphere, are differently affected by the sun's influence through the day, the barometric diurnal variations are determined by the composition of the two together; & thus there are two daily maxima and two daily minima of the barometer, different at different places, in time as well as in degree.

(15)

The most constant causes of variation in the pressure of the air as shown by the barometer are, changes in the amount of vapor, and changes in the temperature and height of the gaseous atmosphere.

Every day both of these change somewhat regularly, at least when the sky is clear. The vapor in the air is least at Philada. an hour before sunrise. As the sun ascends, he raises, by his heat, moisture from the surface of the earth, all day, till a little before sunset. Then, with the cooling of the earth and air, the vapor descends and leaves the air. The gaseous atmospheric pressure varies according to another law. It's greatest about an hour after sunrise, and diminishes till about 4 P. M. in this vicinity; then it increases again till morning.

For example:

Suppose the temperature of the air, as shown by the dry bulb, to be 53° F., and the wet bulb thermometer to mark 50°; difference, 3°; — which is the "dryness observed"; By the table in use, it is shown that at the temperature of 53° the difference between the dry and wet bulbs is 1/2 the difference between the temperature of the air and the dew point. So we multiply 3°, the diff. of bulbs, by 2, — and then subtract this product, 6°, from the dry-bull temperature, 53°; — and we get 47° for the dew-point. Now, another table shows that, for this dew-point, the vapor-pressure is .288 (equal to the weight of) of an inch high column of mercury; while, at 53° dew point, it would be equal to .403 of an inch. These numbers, .288 & .403 are to each other about as 72 to 100. The relative humidity of the air then, in the case considered, is 72.

—Hygrodeik—

The easiest thing to obtain first is the difference between the temperature of the wet and dry bulbs.

Tables are then prepared, from observation and calculation, showing the proportion between this difference (= the observed dryness) and the difference between the dry bulb temperature and the dew-point. So and the [redacted] getting this last difference, we subtract it from the observed temperature (of the dry bulb) and thus get the dew-point. Then, other tables show what elastic pressure of vapor each dew-point temperature involves; and by comparing this vapor-pressure of the dew-point with the vapor-pressure belonging to saturation at the temperature of the air at the time, we get the relative humidity as compared with saturation, which is desired.

(See Loomis on Meteorology for Tables.)

18

1) Things desirable to be determined concerning the hygrometric state of the atmosphere:

Absolute amount of moisture;

Amount of moisture compared with amount which will saturate the air at the temperature observed;

This last is practically most important, and is called relative humidity, — or, conversely, dryness, meaning the same; the question how dry is it, being equivalent to how damp is it; just as how high & how low both mean, what is the height compared with a fixed standard.

Items in this determination:

Difference between dry and wet bulb;

Dew-point; Difference between the temperature of the air and the dew-point;

Elastic force or pressure & weight of the vapor present.

RELATION OF THE AIR'S HUMIDITY-TO-TEMPERATURE

The humidity of the air has a constant relation to temperature. It is estimated in several ways (page 16)

LIGHTNESS OF MOIST AIR.

(2) Moist air is lighter than dry air, on account of its expansion. This is indicated by the barometer which however shows better the pressure of winds. Hygrometry & Hygroscopy.

WEIGHT OF Dry & Moist AIR AND OF VAPOR.

(1) A cubic ft. of dry air, at 60° weighs 536.28 grs; of vapor, 547 grs;— of air saturated with water, at— 60° 532.84 grs., 0° 606 grs., 100° 486.65. air is saturated at 52° F by 4½ gr. of aq. vap. to 1 cub. foot; at 77°, 9.8 gr.

The comparative weight will give the relative humidity. [Barom

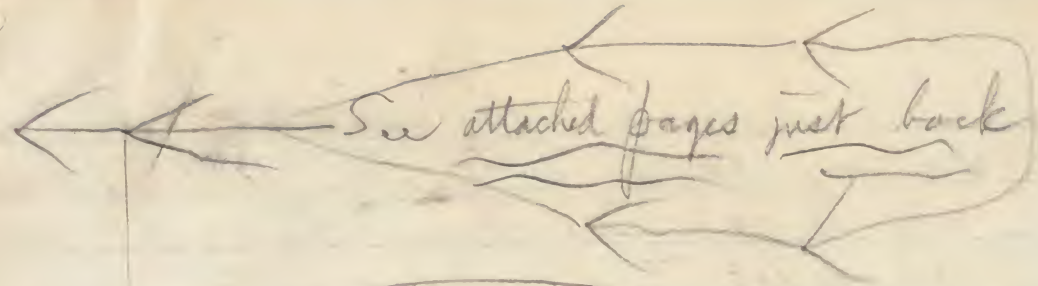
DANIEL'S HYGROMETER.

(3) The principle in Daniell's hygrometer, is the dew-point, or the temperature at which moisture will begin to condense, upon a body gradually cooled.

If the air is very dry, there will be no dew. There is none in N. Mexico, Egypt & Peru.

DEW-POINT.

The dew point is taken by cooling down the bulb of the thermometer. Dew is produced by the



There are
2 kinds of

Barometer

; Mercurial & aneroid.
most exact; consists its principle.
metal Box & index.

[Space of ½ page]

Dr A. Flowers's paper on effect of atmosphere state on Mortality of Surg. operations (Penn. Hosp. Report for 1868)
259 operations 30 p.c.
Most deaths from shock, very dry air; most from fever & pyæmia, damp. Ascending barometer most favorable, if steady; next, stationary, — least so low and descending barometer, - i.e., diminution of pressure.
Bert, in France, has recently made similar observations. [?]
Electrical relations probably have place here. Increased pressure of the air has been, in Europe, sometimes used remedially. In climbing high mountains, its diminution is felt. — Marine animals.
[space blank]

Boston J

VOLUME VII.

Familiar Science.

THE CHROMOSPHERE.

BY PROF. C. A. YOUNG.

THE Chromosphere, or "color-sphere," is the sheet of scarlet flame enveloping the more intensely luminous and still hotter photosphere which constitutes the visible surface of the sun.

The chromospheric flames, however, differ from terrestrial flames in this; that in them, so far as we can learn, nothing is being burned up. Like the electric spark and the voltaic arc in vacuo, they seem to consist merely of masses of intensely heated gas absolutely too hot to burn — at a temperature above what chemists call the "disso-

DRY AND WET BULBS.

Dry & Wet bulbs,
the humidity of th
in the shade, a
ground. The we
with cold muslin
cotton which di
thus kept consta
ence between the
humidity; as evaporation
relative

WAY TO KEEP THE BULB WET.

The cotton sho
rated with carb
water should be

HAIR HYGROMETERS.

Human hair
hygrometer. It is
graduated. On
which moves as
contracts. It kee
or three months.

Electricity
Atmospheric
implement.

CURIOUS TOY.

A curious toy
with two doors is
It is so contrived
air is moist a

the atmospheric glare
that glimpses of the prominences might be ob
tained by this simple means, and the experiment was tried upon the Peak of Teneriffe in 1851, but without success.

Thus far the spectroscope alone furnishes the means of overcoming the difficulty.

The air-light, being simply reflected sunshine, is *white*, consisting of an infinite number of rays of as many different hues gradually shading into each other; and although this whole collection of different colored rays forms in its combination a brilliant light, yet the individual rays taken separately are not very powerful.

The light from the chromosphere, on the contrary, is composed of only a few different kinds of light, and although as a whole, much less brilliant than the aerial illumination, its separate components far surpass in power the corresponding rays of the air light.

Now the peculiar effect of the spectroscope is to separate the different-hued rays of light, and to spread them out into a spectrum. When we thus disperse the white light of the air, and so diminish the brightness of the background, the colored rays of the chromosphere become easily visible. This beautiful application of the spectroscope was independently invented by Janssen, one of the French observers of the eclipse of 1868, and by Lockyer, who was a few weeks later, simply because his instrument was not finished in season.

For observations of this nature the spectroscope, which should have the highest attainable dispersive power, is attached to a telescope in such a way that the image of the sun formed by the object glass may fall accurately upon the slit. It is then adjusted so as to bring the so called C line upon the cross-wires. On looking into the instrument one sees a broad red band reaching across the field of view. (In a powerful spectroscope of course only a small portion of the spectrum is visible at once, and when the red is in sight the other colors are out of the field.) This band is barred with many fine dark lines, of which C is by far the most conspicuous; now move the telescope a little until the slit becomes exactly tangent to the edge of the sun's image, and just as the rest of the spectrum fades away, the C line, before perfectly black, flashes out with an intense scarlet brilliance which almost invariably extorts an exclamation of surprise and delight from an unaccustomed observer.

Now widen the slit a little by its adjusting screw, and you see a portion of the chromosphere, with the beautiful cloud-forms that float above it, as when one looks out upon a sunset sky through half-opened blinds from across a darkened room.

In this way the chromosphere and prominences can be seen and studied, not perhaps quite

north of east and terminates from the north of west; and in the southern parts the wind generally sets in from the south of east and terminates from the south of west.

During the passage of storms the wind generally changes from the eastward to the westward by the south, especially in the southern parts of the United States.

The northern part of the storm generally travels more rapidly toward the east than the southern part.

During the high barometer of the day preceding the storm it is generally clear and mild in temperature, especially if very cold.

The temperature generally falls suddenly on the passage of the centre of great storms, so that sometimes, when a storm is in the middle of the United States, the lowest temperature of the month will be in the west on the same day that the highest temperature is in the east.

The first of the principles upon which the Signal Corps proceeds is that the invariable course of air currents is such as will equalize the atmospheric pressure upon the earth's surface, and that wherever inequalities exist, the winds are set in motion, the air thus finding its level, just as water or any other visible fluid does.

FACTS WITH REGARD TO STORMS.

A VAST amount of information is constantly being gathered and collated by the U. S. Signal Service, out of which is being gradually built up the true science of that class of meteorological phenomena. Among the general observations thus far noted, may be mentioned the following: —

Storms are accompanied with a depression of the barometer near the central line of the storm, and a rise of the barometer in the front and rear.

This central line of minimum pressure is generally of a great length from north to south, and moves side foremost toward the east.

This line is sometimes nearly straight, but generally curved, and most frequently with its convex side toward the east.

The velocity of this line is such that it travels from the Mississippi to the Connecticut River in about twenty-four hours, and from the Connecticut to St. John, Newfoundland, in nearly the same time, or about thirty-six miles an hour.

When the barometer falls suddenly in the western part of New England, it rises at the same time in the valley of the Mississippi, and also at St. John, Newfoundland.

In great storms the wind for several hundred miles on both sides of the line of minimum pressure blows toward that line directly or obliquely.

The force of the wind is in proportion to the suddenness and greatness of the depression of the barometer.

In all great and sudden depressions of the barometer there is much rain or snow; and in all sudden great rains or snows there is a great depression of the barometer near the centre of the storm, and rise beyond its borders.

Many storms are of great and unknown length from north to south, reaching beyond our observers on the Gulf of Mexico and on the northern lakes, while their east and west diameter is comparatively small. The storms therefore *move side foremost.*

Most storms commence in the "far west," beyond our most western observers, but some commence in the United States.

When a storm commences in the United States the line of minimum pressure does not come from the "far west," but commences with the storm, and travels with it toward the eastward.

There is generally a lull of wind at the line of minimum pressure, and sometimes a calm.

When this line of minimum pressure passes an observer toward the east, the wind generally soon changes to the west, and the barometer begins to rise.

There is generally but little wind near the line of maximum pressure, and on each side of that line the winds are irregular, but tend outward from that line.

The fluctuations of the barometer are generally greater in the northern and the eastern than in the southern and the western parts of the United States.

In the northern parts of the United States the wind generally in great storms sets in from the

In England, the dew point is 35°
in our Northern States 16°, often as low as 9°

DRY AND WET BULBS.

When a Dry & Wet bulbs, are used to determine the humidity of the air, they are put in the shade, about 4 ft. from the ground. The wet bulb is covered with cold muslin and then with cotton which dips in water. It is thus kept constantly wet. The difference between the two will show the humidity; as evaporation cools the wet bulb if the air is not saturated.

WAY TO KEEP THE BULB WET.

The cotton should first be saturated with carbonate of soda. The water should be rain water or distilled water.

HAIR HYGROMETERS.

Human hair has been used as a hygrometer. It is stretched out and graduated. On one end is a needle which moves as the hair expands or contracts. It keeps accurate for two or three months. (Saussures) Ropes!

CURIOUS TOY.

A curious toy consisting of a house with two doors is a good hygrometer. It is so contrived that when the air is moist a man comes out & one

Chem. Hygroscope — Camphor

End of 14th Lecture, 1870

End of 14th Lecture, 1868.

End of 23d Lecture, 1871

End of 17th Lecture, 1873

This indicates the propriety of considerable addition of moisture to the air of heated rooms.

Dr. Wetherill estimated that the Halls of Congress ought to have nearly 8 gallons of water evaporated every hour for the proper hydration of their atmosphere. My impression is (although not definitely informed about it) that, by Wetherill's others, a good deal of pains & skill have been given towards providing arrangements for good air in the Capitol at Washington. It is probable that instead of being (1876), as one representative expressed it, "murdered by scientific ventilation" the congressmen are suffering from very unscientific neglect of the proper use of the means that are provided.

At the Smithsonian Institution, steam is added to the air of the air chamber of the furnace by which the building is warmed. This was introduced there by Prof. Henry, who has long been at the head of the Institution. The principle thus illustrated is important in buildings of all kinds. Stove heat &

(Wetherill, Franklin Inst. Journal, 1869)

Relative humidity of air varies from saturation, 100, to 12 or less.

Mean at Washington, 1856–64, 68.15.

Müller, at Halle, Germany, mean 75.

At Philada., in 12 years, 68.5 (Loomis says 70.) Roscoe found it most agreeable in the House of Lords in London, not below 55 nor above 82; mean between these extremes being 68.5. In Mammoth Cave, Ky., pleasant for exercise when, with temperature 58° Fahr, rel. hum. is 87.6. (Wetherill) A very good mean, no doubt, is 67.5.

Every expired breath adds about 17 grains of aqueous vapor to each cubic foot of exhaled air. (Each adult gives out in breathing from 12 to 18 gr. water vapor each minute.

But, by warming the air, its relative humidity is proportionately reduced. By raising the temperature from 50° to 70° Fahr., rel. hum. reduced from 100 to about 25,

End of 23d Lecture, 1871

End of 17th Lecture, 1873

door, and when it is dry, a woman comes out of the other.

Two practical measures of adjustment are 1st Making a fire on a damp day. This is especially important in malarial regions and in basements; in Spring & Fall often neglected.

MAKING A FIRE ON A DAMP DAY.

2nd. Always keeping water on stoves and furnaces. Stove air is very uncomfortable if this precaution be not taken.

KEEPING WATER ON YE STOVE.

OZONE.

Ozone is the next constituent of the air. The whole subject of ozone is unsettled. There are facts concerning it, which can not be ignored, even if we do not admit their importance.

Discovered by Van Marum 1785

Schönbein

ITS DISCOVERY.

~~Richardson~~ Schönbein discovered it in 1839 and published a work on it. He thinks is oxygen in an active state, having intense affinities.

OZONE ANTOZONE OXYGEN.

Schönbein ~~says~~ believed that there are three states of oxygen, 1st. ozone, 2nd antozone 3rd ordinary oxygen, union of the two others. Probably antozone is really peroxide of hydrogen.

ELECTRICITY.

Electricity produces ozone. Its sources in the atmosphere, are ~~necessa~~

not sources of formation of Winds —

Sea —

Plants (Cryptogams in oceans, fresh water Lakes — not in earth)

See Hydrone

May 1873 Montgomery on Ozonous Flowers

How to make ozone.

Electrical sparks thro' oxygen gas —

Piece of phosphorus just under water

Glass rod, heated, in ether vapor —

Action of SO_3 on peroxide of barium

Exposure of oil of turpentine to the air — &c

Decomposition of permanganate of potass. by SO_3.

Properties of ozone — [Spare 6 lines]

odor — &

density — 1½ to 4 times heavier than O

(Towner)

Somewhat

as yet uncertain ~~ity, mere speculation~~. It is estimated that 10,000 (.0001) of the air is ozone.

PHOSPHORESCENCE.

Moffat thinks that phosphorescence of the sea has something to do with it.

EQUATORIAL CURRENTS.

Some say, the Equatorial wind currents carry ozone.

Or, friction of waves of the sea

CHOLERA.

~~Some say that it will prevent cholera.~~

Ozone smells (chlorol.) & is 2/3 or less of Nitrogen 3 vols cond. to 2. of oxygen.

IT STOPS DECOMPOSITION.

Its effect on dead organic matter is to stop decomposition. It destroys india rubber, & oxidizes metals, even silver.

IT PURIFIES.

It is a purifier, and is of immense importance in the natural disinfection purification of large cities. Is consumed in foul places.

IRRITATING WHEN CONCENTRATED.

When concentrated it is irritating to the mucous membrane, ~~and may even cause death~~. It requires a temperature above 60° and below 75° to show its properties.

CARNIVORA

Carnivora are most easily affected by it; rats more than rabbits.

INFLUENZA.

Influenza has been associated with ozone. The reasons for this are that ozone is irritating to the breathing apparatus, and that an excess of ozone has been noticed sometimes when influenza has prevailed.

B. W. Richardson

REASONS FOR THE ASSOCIATION.

Test for ozone made uncertain by the same reaction occurring with ~~nitrous~~ (See my loose notes),

~~Nitrous~~ Nitrous acid, oil of cloves?, &c —

Meissner has shown that when oxygen is ozonized by elect. & led through iodid. potass. — evg traces of ozone removed — if the gas so emerging is passed thro pure water — a thick white mist appears on its surface — which can be poured like Oil —

"Atmozone" — meissner thinks identical with antozone. Gradually disappears in atm experiments.

COLDS.

CROUP.

BRONCHITAS.

PNEUMONIA.

APOPLEXY.

EPILEPSY

Colds
ed by th
Dr. Moffat
chitas a
Eighti
from a
occured
excessive.

Lactic (Formic Acids) from sanitary point
certain test for ozone – oxidation of silver
by passing current of moist air over it –
the test-paper is affected by nitrogen, fer-
mented water, ammonia, formic acid,
essential oils, acid products of combustion,
dusts.

been said to have

ANTOZONE.

Schönbein

Antozone was discovered by Richardson. He inhaled air & had the CO_2 taken out, and inhaled it again and again until he found that the oxygen lost its vital power.

PROMOTES PUTRIFACTION

Antozone promotes putrefaction.

TESTS FOR OZONE.

The test for ozone is its action on starch and iodide of potassium.

STARCH & IODIDE OF POTASSUM.

We use 200 pts. distilled HO, 10 of starch and 1 of iodide of potassium. The ozone sets the iodine free and colors the starch blue

& NOS & some vol. oils the same

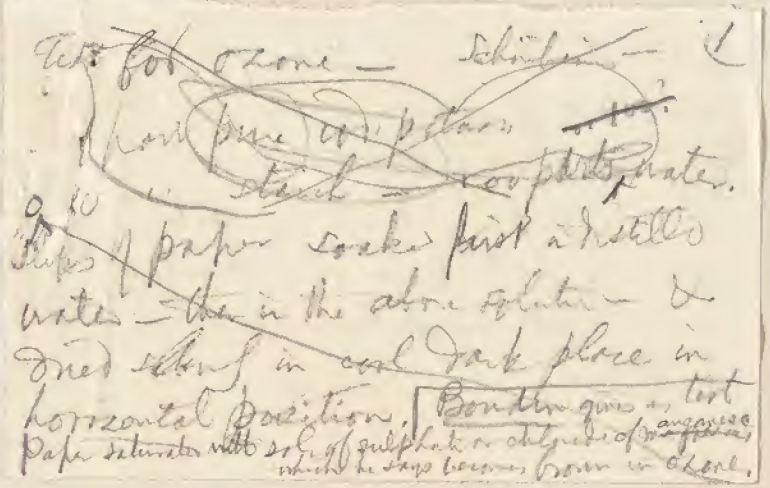
or iod. potass. paper without starch, the iodine red being brought out.

There are other tests. Boudin's consists in the action of ozone on

or iod. pot. & reddens litmus paper

SULPHATE OF MANGANESE.

sulphate of manganese, giving a brown precipitate. Houzeau, wine-dried [illegible] paper, 1/2 [illegible] with iod. potass.; ozone [illegible] blue by forming alkali [illegible]



Meissner has shown that when oxygen is ozonized by elect. & led through iodid. potass. — every trace of ozone removed — if the gas so emerging be passed thro pure water — a thick white mist appears on its surface — which can be poured like Cream —

"Atmozone" — meissner thinks identical with antozone. Gradually disappears on aborn experiment.

COLDS.

CROUP.

BRONCHITAS.

PNEUMONIA.

APOPLEXY.

EPILEPSY

ANTOZONE.

PROMOTES PUTRIFACTION

TESTS FOR OZONE.

STARCH & IODIDE OF POTASSUM.

SULPHATE OF MANGANESE.

Colds are caused by ozone, generated by the friction of currents of air. Dr. Moffat thinks it causes croup, bronchitas and pneumonia.

Eighty per cent of the deaths from apoplexy and epilepsy, have occured on days when ozone was excessive.

Antozone was discovered by Richardson. He inhaled air & had the CO_2 taken out, and inhaled it again and again until he found that the oxygen lost its vital power.

Antozone promotes putrefaction.

The test for ozone is its action on starch and iodide of potassium. We use 200 pts. distilled HO, 10 of starch and 1 of iodide of potassium. The ozone setts the iodine free and colors the starch blue.

There are other tests. Boudin's consists in the action of ozone on sulphate of manganese, giving a brown precipitate.

Burdel, a French savant, in some elaborate investigations did not find absence of ozone to correspond with fever-malaria (Parkes.) ~~Hygiene~~.

* difficulties = Marks observations upon it.

When ozonized oxygen is passed through iodide of potassium, all the ozone is lost.

OZONE OVER LAKES.

Clemens found ozone given off abundantly, just over lakes. Over marsh water the oxygen is not ozonized; over good water, it is.

SUPPOSED EFFECT ON MALARIAL FEVERS.

Dr. Hammond observed that in two encampments, one on a river bank and the other, half a mile from it, that the former had malarial fevers and the latter had not. It was found that in the former place, there was a deficiency of ozone, and in the latter, there was an excess.

CHOLERA.

The same statement has been made in regard to cholera, but it has been contradicted after careful experiments.

~~Clemens ascribes ozone to currents of air over water.~~

DISCREPANCIES.

Mitchell in Algiers found many discrepancies in the statements concerning ozone. Its disinfectant value is strongly asserted by some, (of air)

NON-ESSENTIAL CONSTITUENTS.

The finally non-essential constituents

[Bowl copy] for Black Board

3d (1872) Lecture.

Germ Theory of Disease.

1. It is proved that the air contains a multitude of minute animal and vegetable organic forms; aerophyta, aerozoa, spores and germs; especially where the air is impure.

2. It is known, also, that (besides entozoic and epizoic animal parasites) microscopic vegetations grow upon the skin in favus, mentagra, &c, and in the throat in thrush; perhaps in diphtheria.

3. It is asserted by Pasteur and others that fermentation and putrefaction depend upon the ~~influence~~ of minute organisms, mostly derived from the air.

4. It is inferred, that many diseases, as fevers, cholera, influenza, diphtheria, may be, in like manner produced by organic air-germs; and that the suppuration of wounds, pyæmia, ~~putrefaction~~ and hospital gangrene are so caused.

5. These conclusions, however, are not yet demonstrated. It is probable that many aerial organisms consume septic matter so as to purify the air; while some of them only, are vehicles of disease; especially where they multiply out of proportion to the material on which they live; & when the bodies of those which they bear are feeble.

come next.

IODINE. 1. Iodine is found in small quantities especially at the sea shore. It is absorbed to the extent of 4/5. It acts on the system; hence perhaps the good in cases of scrofula.

NITRIC ACID 2. Nitric acid is found in very small amounts. It is most after a thunder storm. Hence the souring of milk attributed to thunder.

AMMONIUM. 3. Ammonia is another constituent. There is more at night, and more in crowded rooms. It has been incorrectly denied that ammonia is exhaled from the lungs.

NITROUS ACID. 4. Nitrous acid.

SULPHURIC & SULPHUROUS ACIDS. 5&6. Sulphuric & sulphurous acids are particularly present in large towns where coal is burned. Sulphur is present in every house as is shown by the tarnishing of silver.

SULPHURETTED HYDROGEN. 7. Sulphuretted hydrogen arises from decay of organic matter. Privies give it off as do marshes,

End of 2nd Lecture, 1872

Seen burning with blue flame on the top of a coal fire; formed below, in the middle of the coal from imperfect combustion. Observations on injurious effects of Cast-iron stoves: probably from CO escaping through. Horner first noted this.
Dr. Derby of Boston, a treatise on the subject. —
Experiments carefully made show that but little can leak through solid cast iron.

Space of 8 lines

and certain volcanoes and mineral springs, & grave yards.

As a gas, it is very unwholesome. ~~1/800 of the air~~ 1/800 will kill a small animal. 1/250 will kill a horse | 2 Paris decrees, workmen hour 24 to 90 parts in 1000. |

ITS DETECTION. It is detected by its blackening lead. ~~Hence~~ Lead salts are also its best destroyers.

It does not produce malarial fevers. Daniell in Africa thought it did.

CARBURETTED HYDROGEN. 8. Carburetted hydrogen is of two kinds; heavy & light. The latter is the explosive ~~in~~ fire-damp of mines. It is not a positive poison. Davy.

CARBONIC ACID. 9 Carbonic oxide comes from fires and burning-gas. It is poisonous

CARBONIC OXIDE. ~~Carbonic acid is not as bad as carbonic oxide.~~

PHOSPHURETTED HYDROGEN. 10 Phosphoretted hydrogen is rarely met with. These are all the gases

ORGANIC MATTER. ~~& to be met with in the air~~ The air contains ~~also~~ organic matter. Some of these are ~~odorous~~ and ~~some~~ has odor, and some ~~is~~ is deliquescent

End of 15th Lecture 1867.

~~End of 14th — 1869~~

a meeting ~~address~~ of 1867 held on 1st Patient in the Chest Hospital this city who, having been for 18 years engaged in an establishment for making a kind of black paint, — although he had left it 12 mos, experienced a good deal of black matter, he expectorated. "Collier's lung."

with coal tar &c.

"aerozoa — aerophyta —"